

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) A device for the calibration and equalization of reception chains of an antenna processing system, comprising:

a radiating element having several RF (radiofrequency) chains, each associated therewith;

a set of sensors C_i formed out of the outputs of the RF chains;

a channel for the injection of a calibration signal; and

means to couple the calibration signal to the sensor signals and several reception-digitization chains:

a processor adapted to manage all the devices;

a means used to adjust the value of the gain of an RF chain to a minimum value G_{min} ;

a means for deflecting the sensors, adapted to minimizing the sensors ~~their~~ directivity toward the interference sources;

a means adapted to adjusting the level of the injected calibration signal S_T relative to the signal of the sensors; and

an RF chain having a gain adjusted to a minimum value G_{min} .

2. (Original) The device according to claim 1, wherein the means of injection of the calibration signal are, for example, couplers.

3. (Original) The method of the calibrating and equalizing of reception chains of an antenna processing system comprising several RF chains, one per radiating element, several RF chains being associated with a formed sensor C_i , comprising the following steps:

injecting a calibration signal $S_T(t)$ at the level of the sensor signals $S_C(t)$;

setting the value of the gain of the chains RF to a minimum value of gain Gmin;
 adjusting the injected calibration signal $S_T(t)$ as a function of the level of the signal of the sensors; and
 deflecting the sensors C_i in order to minimize their directivity toward the interference sources.

4. (Original) The method according to claim 3, wherein the signal is injected by means of couplers.

5. (Original) The method of calibration according to claim 3 wherein, for each value of sensors n and for each of the M frequency positions f_i , $1 \leq i \leq M$, of the line i in the digitized band, an estimation is made of the quantity $T_n(f_i)$ reduced to baseband by the computation, using a Discrete Fourier Transform (DFT) of the K samples $x_{ni}(k)$ acquired on the channel n for the line i , of the frequency response $X_n(l_i)$ for the discrete channel l_i associated with the line f_i :

$$X_n(l_i) = \sum_{k=0}^{K-1} x_{ni}(k) \exp(j2\pi kl_i/K) \quad (10)$$

where l_i is linked to f_i by the following relationship

$$\text{If } f_i < F_e/2 : l_i = \text{Near}[K f_i / F_e] + K/2 \quad (\text{modulo } K)$$

$$\text{If } f_i \geq F_e/2 : l_i = \text{Near}[K f_i / F_e] - K/2 \quad (\text{modulo } K)$$

where Near(x) corresponds to the integer closest to x.

6. (Original) The method of calibration according to claim 5, wherein said method of calibration determines the reference channel $X_1(l_i)$ and the estimated value, $\hat{h}_n(l_i)$, of $h_n(f_i)$ reduced to baseband (between $[-F_e/2, F_e/2]$), by $\hat{h}_n(l_i) = X_1(l_i) / X_n(l_i)$.

7. (Original) The method of calibration according to claim 6 comprising a step in which the frequency response of the equalizing filters is dictated for the measurement points located in a small transition band, located on at least one of the two ends of the digitized bands, by linear

interpolation on the points of the transition band between the last measurement point of the digitized band with a width F_e and the first measurement point of this digitized band.

8. (Currently Amended) The method according to claim 7, comprising a step for synthesizing an FIR filter as follows:

~~it is considered that~~ the sequence of the M frequency samples, $\hat{h}_n(l_i)$ ($1 \leq i \leq M$) corresponds also to the sequence $\hat{h}_{n,\square}(u_i) \stackrel{D}{=} \hat{h}_{n,\square}(u_i)$ ($1 \leq i \leq M$) where $u_i = l_i \square$ and where \square corresponds to the value of l_i closest to zero which thus corresponds to one of the values of u_i ;

the reverse Fourier transform, $\hat{h}_n(k)$ ($0 \leq k \leq M-1$), of the M frequency samples, $\hat{h}_n(u_i)$ ($1 \leq i \leq M$) is computed and, to do this:

the sequence $\hat{h}_n(l_i)$, corresponding to a frequency representation between $[-F_e/2, F_e/2]$ is periodized so as to obtain a representation between $[0, F_e]$, the sequence $\hat{h}_n(l_i)'$ being obtained;

the reverse Fourier Transform of the sequence $\hat{h}_n(l_i)'$ is built, the reverse Fourier Transform this sequence giving the sequence of time samples $\hat{h}_n(k)$:

the sequence $\hat{h}_{n,\square}(k) = \exp(j2\pi\square k/M) \hat{h}_n(k)$ ($0 \leq k \leq M-1$), and then a non-causal version of this sequence are built, in reordering these coefficients, and then the sequence: $[\hat{h}_{n,\square}((M-2)/2+1), \dots, \hat{h}_{n,\square}(M-1), \hat{h}_{n,\square}(0), \hat{h}_{n,\square}(1), \dots, \hat{h}_{n,\square}((M-2)/2)]$ is built;

the preceding non-causal sequence is truncated to R values, in eliminating the first and last values of the sequence and then, , for $R = 2q + 1$, there is obtained a sequence written as $\hat{H}_{n\square} = [\hat{h}_{n,\square}(-q), \dots, \hat{h}_{n,\square}(-1), \hat{h}_{n,\square}(0), \hat{h}_{n,\square}(1), \dots, \hat{h}_{n,\square}(q)]$, the preceding non-casual this sequence corresponding to the sequence of coefficients of the equalizing filter of the channel n .

9. (Original) The method according to claim 8, comprising a step of:

filtering the samples $x_{ni}(k)$ coming from the reception channels by the impulse responses of the previously computed equalizing filters,

delaying the samples $x_{1i}(k)$ of the reference channel 1, which is not equalized, so as to compensate for the phase lead of these samples relative to the equalized samples of the other channels, induced by the non-causal filtering operation for the channels 2 to N.

10. (Original) The method of calibration and of equalization according to claim 3 comprising a step for the detection of malfunctions in which each coefficient of the equalizing filter is compared with a threshold value.

11. (Original) The method of calibration and of equalization according to claim 3 comprising a malfunction detection step in which:

from the samples $x_{nj}(k)$ ($0 \leq k \leq \tilde{K} - 1$) acquired at output of the reception chain n excited by the line f_j , the method builds the outputs $y_{nj}(k)$ of the equalizing filter, associated with the channel n for the excitation considered

$$y_{nj}(k) = \sum_{i=-q}^{+q} \hat{h}_{n,\square}(i) x_{nj}(\tilde{k}i + q) \quad (0 \leq k \leq K + \tilde{1} - R) \quad (16)$$

where q corresponds to the number of delayed samples of the channel 1;

a computation is made of the mean complex error associated with the channel n and with the line j defined by

$$e_{nj} = 1/(K - R) \sum_{k=0}^{K+1-R} (y_{nj}(k) \cdot \tilde{y}_{1j}(k)) \quad (0 \leq k \leq K + \tilde{1} - R) \quad (17)$$

if there exists at least one line position j such that:

$$E_{max} \leq |e_{nj}| \quad \text{or} \quad \square\square_{max} \leq \text{Arg}(e_{nj}) \quad (18)$$

where E_{max} et $\square\square_{max}$ are thresholds that are decided upon *a priori*, then a malfunction is detected.

12. (Currently Amended) The [[A]] use of a the device for the calibrator and equalization of reception chains of an antenna processing system according to claim 1 for the calibration and equalization of sensors on board a satellite.

13. (Original) The method of calibration according to claim 4 wherein, for each value of

sensors n and for each of the M frequency positions f_i , $1 \leq i \leq M$, of the line i in the digitized band, an estimation is made of the quantity $T_n(f_i)$ reduced to baseband by the computation, using a Discrete Fourier Transform (DFT) of the K samples $x_{ni}(k)$ acquired on the channel n for the line i , of the frequency response $X_n(l_i)$ for the discrete channel l_i associated with the line f_i :

$$X_n(l_i) = \sum_{k=0}^{K-1} x_{ni}(k) \exp(-j2\pi k l_i / K) \quad (10)$$

where l_i is linked to f_i by the following relationship

$$\text{If } f_i < F_e / 2 : l_i = \text{Near}[K f_i / F_e] + K / 2 \quad (\text{modulo } K)$$

$$\text{If } f_i \geq F_e / 2 : l_i = \text{Near}[K f_i / F_e] - K / 2 \quad (\text{modulo } K)$$

where $\text{Near}(x)$ corresponds to the integer closest to x .

14. (Currently Amended) The use of ~~the~~ a method for the calibrator and equalization of reception chains of an antenna processing system according to claim 3 for the calibration and equalization of sensors on board a satellite.